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Fiscal Year 2002 Annual Report

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Executive Summary

This report provides a summary of the key accomplishments of the Navy MANTECH Program during FY 02. In particular, we have focused our actions in five areas:

- ***Transitions and accomplishments*** including rapid actions to support the Fleet and new starts that support high priority Naval weapon systems.
- ***Leveraging the resources of organizations*** other than Navy MANTECH that provide support for the Navy MANTECH Centers of Excellence (COEs) resulting in a reduction in Navy overhead expenses.
- ***Major outreach actions*** to demonstrate the benefits of the MANTECH Program to Navy PEOs, Program Managers, and others through direct meetings, participation in major conferences, and demonstrations of technology.
- ***Articles published in professional journals*** by Navy or COE MANTECH personnel including thirteen peer-reviewed papers in internationally recognized journals.
- ***MANTECH Program improvements*** based on guidance such as Sea Power 21 and the National Research Council report "Equipping Tomorrow's Military Force".

The Navy MANTECH Program has continued to efficiently and effectively enable the transition to production of technology for the fleet through responsive actions. Highlights from the report are provided below.

- MANTECH had thirteen significant accomplishments and transitions. An example is:
  - In response to a request from PMA202, a MANTECH rapid response project solved a repair problem on PRC-112 survival radios for Operation Enduring Freedom. MANTECH identified the underlying problem and rapidly found a workable solution.
- Eleven new MANTECH projects commenced that are consistent with Sea Power 21 and the highest priority needs of the Navy. Examples include:
  - The LINK-16 project is addressing electronic miniaturization manufacturing improvements for the Power Amplifier of the LINK-16 Multifunction Information Distribution System Low Volume Terminal.
  - The Wide Band Gap Semiconductor effort with ONR Code 31 is addressing manufacturing maturation to enable affordable production of high power SiC MMIC power amplifiers for shipboard radar, electronic warfare, communication, and navigation systems applications.
- MANTECH executed and managed eight high visibility, manufacturing technology-related Congressional Interest Programs. An example is:
  - The Composite Twisted Rudder project is demonstrating the fabrication of a composite rudder for the DDG 51 that will reduce acquisition and life-cycle costs, provide enhanced corrosion performance, reduce weight aft, and improve ship survivability through reduced magnetic signature.

The Navy MANTECH Program had a notable year in leveraging of resources. With a total FY 02 appropriation of $75.6M, Navy MANTECH obtained additional funding of $91.5M (121% of appropriated funding) from other sources:

- Non-Navy MANTECH Funds received by Navy COEs -- $47.8M.

- Cost Sharing of Navy MANTECH projects by industry and other government agencies -- $18.0M.
- Congressional Interest Programs managed by Navy MANTECH -- $25.7M.

MANTECH Web sites were extremely active in FY 02 and proved to be a beneficial resource to government and industry for achieving the MANTECH objectives and disseminating the results of MANTECH efforts.

- As an example, the Electronics Manufacturing Productivity Facility's (EMPF's) Web site provided users with information on their technical Helpline where they can talk directly to EMPF engineers and technicians.
  - The Helpline handled 843 total calls in FY 02.
  - These calls produced 158 quotes, 68 of which developed into Demonstration Factory projects generating over $500K to the EMPF that was used to support Navy MANTECH Projects.

The Navy MANTECH Program continues as a vital element for achieving the timely and cost-effective transition of new technologies from S&T into producible materiel for the sailor. Through its ONR staff and its COEs, MANTECH provides the Navy with the resources for identifying and addressing manufacturing issues for new weapons technologies as well as the repair and re-manufacturing of current systems. This expertise is being made available to the OSD Counter Terrorism Technology Task Force as needed to support its efforts to rapidly transition technology. Program improvements being implemented in FY 03 and FY 04 will enhance the MANTECH Program's responsiveness to Sea Power 21 and Naval transformation.

Table of Contents

1. Transitions and Accomplishments

a. Navy MANTECH Transitions and Accomplishments:

MANTECH focuses on transitioning manufacturing technology to private and government industrial entities that manufacture and repair systems and components for the Fleet. The transitions and significant accomplishments in FY 02 are presented in the following table arrayed against the principal system category. Of particular note are:

- The Monolithic Ring Laser Gyro transitioned to the AGM-154 JSOW Missile with reduced hand labor and manufacturing costs as well as improved yield resulting in a projected total cost avoidance of $14.1M.
- The development of a process for the trouble-shooting and repair of the Transmit/Receive Module of the PRC-112 Survival Radio. This enabled the Army to supply additional radios to Army and Navy units for Operation Enduring Freedom.
- The development and validation of rapid manufacturing for Trident submarine motor covers for Puget Sound Naval Shipyard. This is an example of the application of funding from Congressional Interest Programs for addressing Fleet manufacturing technology needs.

FY 02 Transitions and Accomplishments

Transition / Accomplishment	Background / Purpose	Navy Importance / Relevance
Ships		
Remote Source Lighting (RSL) transitioned to LPD 17 Amphibious Assault Ship (potential use on DD (X), DDG class ships, and CVN 77).	Results of Remote Source Lighting ATD conducted on DDG 78 (Porter) showed need to reduce cost of RSL systems to that of conventional lighting systems for Navy ships.	• Reduced life-cycle cost by $275K per ship over 40 year life. • Reduced EMI/EMP susceptibility via lighting bus. • Improved corrosion control due to elimination of electrical fixtures and light sources from corrosion prevalent areas -- resulting in reduced maintenance costs. • Reduced bulb stocking requirements to approx. 6 types vs. 200 currently for ships. • Improved safety -- personnel no longer required to climb masthead to change bulb.
Implementation of digital photogrammetry to improve process control of plate cutting at Bath Iron Works.	Typically, up to 30% of a ship's total fabrication labor costs are attributed to additional work and rework directly caused by improper fit-up due to excessive tolerance stack-ups. The Project is improving accuracy control of ship structures by developing integrated, automated photogrammetry and computer analysis tools for control of steel cutting and fabrication processes.	• Dynamic measurement of cutting machine alignment during Phase I led to immediate cost savings and improvement in quality of cut parts. • Represents the first use of this technology in the shipbuilding industry. • Expected cost avoidance of 30% as compared to the current baseline is expected due to improved accuracy resulting in reduced fit-up and welding time. • Results of technology expected to assist the DD (X) Program to achieve goals for total ownership cost reduction (FNC).
Developed Light Detection and Ranging (LIDAR) technology "as built" measurements in submarine construction and for lightweight steel construction.	There has been a continuing need for improved measurement techniques for cost reduction, schedule reduction, and accuracy improvement in production shipbuilding. Being implemented by Electric Boat and Northrop Grumman Ship Systems (Avondale Operations).	• Reduced production cost due to replacement of manual dimensionalization with LIDAR processes. • Improved accuracy of measurements. • Improved confidence in sub-unit assemblies individually scanned in different locations and "assembled" together via simulation to ensure proper fit prior to transport and mating -- resulting in schedule reduction.

Transition / Accomplishment	Background / Purpose	Navy Importance / Relevance
Missiles		
Monolithic Ring Laser Gyro (MRLG) transitioned to AGM-154 JSOW Missiles.	Extensive hand labor required for initial build of T-16 gyro. Desire to reduce the labor input / manufacturing cost and improve the yield of the MRLG for the JSOW Missiles.	• Improved yield by eliminating damage to the glass blocks from 80% to 90%. • Improved robotic assembly. • Estimated cost avoidance per unit of $641. • Total estimated cost avoidance = $641/unit x 22,000 units = $14.1M.
Replaced vintage components on Standard Missile Blk III autopilot with Commercial-Off-The-Shelf electrical components for cost avoidance. Technology implemented at Raytheon Missile Systems (EMMA Upgraded autopilot for SM III Blk III).	The Standard Missile utilizes 20 year old technology in several of its systems. Component obsolescence issues forced the evaluation and later integration of Commercial Off The Shelf (COTS) components into a replacement autopilot assembly, enabling the SM III to continue serving the U.S. fleet. For the SM III autopilot, the goal was to design and manufacture a smaller and more lightweight assembly that was supportable and maintainable through the life-cycle of the SM III.	• Proved that specific COTS electrical components could be applied in a hazardous environment requiring high reliability. Use of COTS components has the potential to resolve future program sustainment part shortages. • Space reduction: Baseline volume of 103 in3 reduced to 18 in3 (21 in3 goal) - an 82% reduction. • Reliability: Projected increases in MTBF of 50%. • Cost: Reduction from $18.6K to less than $6K ($6.6K goal) - a 67% reduction. • Projected cost avoidance of over $8M for Standard Missiles Program, based on the first 6 years of production.
Implemented Lean-Pathways methodology at five Boeing suppliers for procurement lead-time reduction on all but four parts, allowing SLAM-ER Missiles program to meet goal of 52-week lead-time for Missile acquisition.	SLAM-ER Missile Program has a requirement to reduce the procurement lead-time of the Missiles to 52 weeks while maintaining or reducing costs. For this Missile, much of the cost and lead-time is found in Boeing's supply base. This structured process, integrating defense with commercial practices, was deployed with suppliers selected based on their strategic importance to the U.S. Navy/Boeing SLAM-ER Missiles.	• Developed & implemented an integrated approach to help five Boeing suppliers (Harris Corp; Karsten Precision; Universal Propulsion Company, Fairfield; Universal Propulsion Company, Phoenix; and Kemco) improve their performance and competitiveness, thereby making the acquisition process more efficient and timely. • Suppliers, on average, reduced cycle time by 37%; reduced set-up time by 87%; and reduced part travel time by 83.5%. • Estimated direct costs avoidance of $350K and cost of capital savings of $150K. • After project completion, all but four part numbers currently do not meet the 52-week Missiles goal; these four parts will be addressed in a Phase II effort.
Created ability for unidirectional electronic exchange of technical data packages (TDPs) through the Internet at Raytheon Missiles Systems and suppliers at significantly less cost and reduced cycle-time. Implemented at Raytheon Missile Systems for AIM-9X, Tactical Tomahawk, and EKV programs, with plans to deploy across all Raytheon Missile Systems in 3 years.	Desire to reduce the cycle time for assembly, validation, approval, and shipping of TDPs (build to print packages) for improved turn-around. Current time assessed at >80 hours by a Raytheon 6-Sigma team. Phase 1 completed and achieved unidirectional flow. Phase 2 will develop bi-directional information exchange capability.	• Unidirectional flow of electronic TDPs between Raytheon Missiles Systems and its suppliers successfully completed. • Deployed in AIM-9X, Tactical Tomahawk, and Exoatmospheric Kill Vehicle (EKV) programs. • Reduced average cycle time (during pilot) from 17 days to 7 days (60% reduction). • Cycle time expected to further decrease as technology more broadly applied and understood. Recent example: TDP creation, verification, delivery, and receipt by supplier achieved in 7 MINUTES. • Direct labor cost reductions when fully transitioned to all Raytheon Missiles systems are expected to exceed $13M annually.

Transition / Accomplishment	Background / Purpose	Navy Importance / Relevance
Provided critical systems engineering support to NAVSEA Standard Missile (SM) Program to ensure this high visibility strategic program successfully completed its critical flight test program with necessary reliability, maintainability, producibility, and performance.	The Best Manufacturing Practices Center of Excellence (BMP) core strengths of risk management, reliability, maintainability, configuration management, transition to production, and COTS integration contribute to the success of overall system capability to intercept a ballistic Missiles target in the ascent phase of flight.	• Impact to the Navy is the 4-for-4 success of SM-3 flight tests. • Additional contributions include the DMSMS working group, Tin Whiskers Working Group, developments and guidance on transition to lead-free parts, Plastic Encapsulated Microcircuit recommendations, and a more effective communication and open management style through the use of the Collaborative Work Environment.
Derived a set of metrics for PEO TSC-M/L to manage Raytheon's production. These metrics are continually posted outside the Captain's door and resulted in Raytheon's improved performance in Operational Test and in the Fleet.	Surveys identify, validate, document and disseminate best practices. The unique, simple BMP process and methodology has nationally recognized validity with results widely used throughout government, industry and academia. Surveys achieve tech transfer through benchmarking, accomplishing measurable improvements in manufacturing technology and production and provide the BMP risk analysis tool with practical, proven, solutions to production problems.	• In general, BMP survey importance and relevance are increased quality, reliability, and maintainability of products and services being procured by the Navy at both major system acquisition levels and the supplier base. • For PEO TSC-M/L, the Program Office traces Raytheon's improved performance in Operational Test and in the Fleet directly back to these metrics.
Torpedoes		
Laser cladding of torpedo shells implemented at NUWC Keyport for Mk 46, Mk 48, ADCAP, and Mk 50 torpedo repair.	Repair methods to torpedo components were limited largely to cosmetic repairs of small defects (smoothing hydrodynamic surfaces). Torpedo components were being disposed of due to damage to shells and lack of more extensive repair capabilities. Need existed for permanent repair, with no degradation of shell strength or corrosion properties, for larger defects, thereby reducing the number of discarded shells.	• Completely integrated into NUWCs depot repair process for Mk 46, Mk 48, ADCAP, and Mk 50 torpedo afterbody, fuel tanks and mid-section aluminum shells. • Significant cost reduction in torpedo repair and overhaul process. • To date, project has provided over $1.3 M cost avoidance due to the ability to return previously scrapped hardware to production. Repairs on cylinder barrels, fuel tanks, nose sections, tail sections, and target battery sections over next 4 years anticipated to be $4.6M.
Marines		
Al 2519 extrusions and forgings implemented in AAAV test vehicles by General Dynamics Amphibious Systems.	Lack of manufacturing understanding and product data prevented GDAS from using Al 2519 extrusions and forgings for structural application in the AAAV. Additionally, the planned Al 5083 extrusions and forgings produce a galvanic reaction with the Al 2519 hull, thereby exacerbating corrosion problems.	• Enabled use of Al 2519 extrusions and forgings in lieu of the previously planned Al 5083 extrusions and forgings to eliminate the corrosion problems between the two materials. • Resulted in significant weight savings over Al 5083 extrusions and forgings. • Enabled life-cycle extension through improved corrosion protection; potential to yield cost avoidance of $16-22M in the production of the planned 1,000 vehicles.

Transition / Accomplishment	Background / Purpose	Navy Importance / Relevance
Aging Fleet		
Manufactured a Trident submarine motor cover as a single component vice the original 27-piece assembly, reducing manufacturing lead time, installation, and possible loss of small pieces.	NUWC-Keyport identified this critical part from Puget Sound Naval Shipyard to demonstrate and validate rapid manufacturing in support of Navy and DOD weapon systems needs.	• Piece part reduction from 27 parts to 1. • Reduced manufacturing lead-time. • Reduced installation time.
Developed trouble-shooting and repair process of transmit / receive module for PRC-112 Survival Radio. Enabled additional radios to be used for Operation Enduring Freedom.	PMA202 identified as immediate fleet need. Rapid Response by MANTECH identified the cause and the repair solution.	• Developed a process for the trouble-shooting and repair of the Transmit/Receive Module of the PRC-112 Survival Radio. • Transferred the processes, test methodologies, and component identification documentation for use in the test, repair and refurbishment of the PRC-112 survival radio to Tobyhanna Army Depot. • Effort enabled the Army to supply additional radios to Army and Navy units for Operation Enduring Freedom.

b. <u>Congressional Interest Programs:</u>

As indicated in the table below, a total of $25.7M was received during FY 02 to execute and manage eight manufacturing technology-related projects. This funding is not within the MANTECH budget line but within other ONR S&T accounts. The efforts are managed by Navy MANTECH personnel to provide maximum benefit to Navy manufacturing and re-manufacturing as well as to augment, wherever possible, ongoing Navy MANTECH projects. Included in the table is the principal Navy application for each manufacturing project.

FY 02 Congressional Interest Programs

Project	FY 02 Funding ($M)	Navy Impact
Ships		
Automated Diode Array Manufacturing	2.6	Developing an automated testing technique for the processing of large diode arrays enabling enhanced materials and reducing the heat load. A fully automated test will improve the reliability and reduce the cost of large diode arrays used in shipbuilding and other Navy systems.
Composite Twisted Rudder	1.0	Demonstrating the fabrication of a composite twisted rudder for the DDG 51 which will correct a cavitation erosion problem on the baseline steel rudder, reduce acquisition and life-cycle costs, provide enhanced corrosion performance relative to the existing steel design, reduce weight aft, and improve ship survivability by reduced magnetic signature.

Project	FY 02 Funding ($M)	Navy Impact
Ship Design & Systems Development Initiative	6.7	Two aspects of this project are the application of Lean Six-Sigma to shipbuilding and the Shipboard Application of Lightweight Structures. Lean process improvement pilots are accelerating the application of Six-Sigma quality improvements at Northrop Grumman and the lightweight structures effort is focused reducing distortion and rework in the fabrication of 5mm-10mm thick plate assemblies for the LPD 17.
Aircraft		
Titanium Matrix Composites	2.6	Demonstrating the manufacturing of Titanium Metal Matrix Composites for rotating engine components such as disks and spacers on JSF. This will permit greater thrust output to weight ratios than are achievable today with currently available engine materials.
Formable Aligned Carbon Thermosets	1.5	This project is refining material fabrication processes and developing part-forming processes for fabricating complex parts using Formable Aligned Carbon Thermosets (fiber stretch breaking). This manufacturing process will enable the low-cost production of complex geometry composite components for JSF, F/A-18E/F, and UCAV-N.
Two Color Focal Plane Array for Missile Warning	4.3	Developing and evaluating manufacturing techniques to reduce the cost and enhance the availability of two color mid-wave staring infrared focal plane arrays for missile warning. Arrays will be delivered for integration into prototype sensors. These funds enabled the continuation of technology efforts initiated in the Navy MANTECH Two Color Infrared FPA project.
Supply Chain Best Practice	2.0	This project, co-funded by Navy MANTECH, is reducing cost and lead times through the application of international standards to PDM and CAD data exchange. Lean processes are being applied to the F/A-18E/F supply chain and have reduced nose landing gear lead time from 56 to 42 weeks.
Aging Fleet		
Electronic Based Manufacturing using 3-D Printing Metalworking Technology	5.0	Demonstrating the integration of powdered metal fabrication and e-manufacturing technologies in the design, production, and evaluation of Navy and DOD weapon systems components. Results from the program will assist in developing processes and techniques for solid free-form manufacturing at costs that are quantity-insensitive.
Total:	**25.7**	

c. <u>High Priority New Starts:</u>

During FY 02, the Navy MANTECH Program initiated eleven new projects encompassing the highest priority needs of Navy weapon systems. An overview of the projects is indicated in the following table.

FY 02 High Priority New Starts

Project	Background / Purpose	Navy Impact
Sea Strike		
MMIC Flip Chip	Develop a high volume production capability with two manufacturers to support silver type MMIC Flip Chip bumping achieving a yield better than 85%.	This process, when utilized with the AESA radar being planned for use in the F/A-18E/F, will result in achieving the NAVAIR unit price goals of the radar system of approximately $110,000 per system.
Composites Affordability Initiative (CAI): Integrated & Bonded Structures Validation	Exploit affordability developments from CAI Phase II and validate the use of bonded composite structures for airframe primary structural applications for high performance aircraft.	Provide manufacturing technologies that will afford a significant reduction in acquisition costs of advanced composite structures for the JSF and UCAV-N. An acquisition cost avoidance of fifty per cent for the advanced composite structures is the objective.
Affordable Integrated Structural Apertures	PEO(T) / PMA231 are seeking the affordable integration of embedded antennas into flight worthy structures. Prior DOD/Industry and Navy programs have addressed smart skins and embedded antenna technology but the technical risks remain high.	This task is addressing the manufacturing issues of tooling, scale-up, form/fit/function, and affordability. The benefits of embedded antenna technology will only be achieved if reliable and cost-effective production can be assured.
CAI: UCAV -N Concept Exploration	Two contractor teams (Boeing and Northrop Grumman) are conducting trade studies and engineering analyses on portions of the air vehicle and will identify promising design concepts, manufacturing approaches, and assembly methods that could lead to an airframe lower in cost than today's systems, while meeting all other requirements.	UCAV-N is to be a new family of unmanned aerial vehicles using a more affordable, carrier-capable airframe to fulfill a variety of mission needs including long range surveillance, communications node, deep precision strike, and suppression of enemy air defense (SEAD).
Sea Shield		
MEMS IMU	Enable expansion of precision guided munitions throughout the USN ordnance arena through the incorporation of MEMs type IMUs.	Currently the ability to provide a high G environment IMU is costly and the size precludes their use in several precision guidance systems. The ability to manufacture a low cost, high G tolerant MEMS type IMU will support the USN direction of affordably expanding its precision guided munitions inventory.
Wide Band Gap Semiconductors	This effort addresses the manufacturing technology areas needing further maturation before high power SiC MMIC power amplifiers can be produced at costs low enough for consideration in next generation systems.	Insertion of WBG devices in EW, Radar, Communication and Navigation systems. The focus of this effort is Shipboard Radar. Funding provided to Code 31 to address the manufacturing aspects of WBG.
Next Generation Silver-Zinc Missile Battery	The objective of this project is to assess, develop, implement, and demonstrate manufacturing technologies for producing high-rate primary reserve silver-zinc batteries for the SM-2 Block III missile.	The primary benefits of this project include reduced variability in both manufacturing and age-related battery performance, higher discharge efficiency, elimination of silver oxide sintering, lower impedance performance, longer shelf life, shorter rise time, and improved reliability. The STANDARD Missile Program Office and Raytheon Corporation are committed to testing and demonstrating the batteries produced using the new technology developed under this project. The technology will be implemented for production of high-rate primary reserve silver-zinc batteries by FY 07.

Project	Background / Purpose	Navy Impact
Sea Basing		
Pathways – LPD 17	The objective of this project is to provide the necessary Lean-Pathways tools and processes for the LPD 17 supplier companies to transform and develop a higher level of enterprise operations and management.	The LPD 17 Program will benefit significantly through reduced program lead-time and costs. All levels (e.g., suppliers, OEM, government) will benefit through improved manufacturing / business efficiencies made possible through process improvements, decreased cycle time, and reduced inventory levels. These improvements will lead to greater product affordability.
FORCEnet		
HIDE – Horizontal Integrated Data Environment	HIDE will automate the updating of drawings and technical data as approved engineering changes are made. This will change how electronic systems are engineered, installed, documented, and logistically supported.	HIDE is projected to provide SPAWAR $12M per year in cost avoidance that will be applied to the accelerated rate of installation of advanced fleet capabilities.
LINK-16	Reduce the cost, size, and weight of the LINK-16 MIDS terminal Power Amplifier by standardizing packaging methods and integrating Wide Band Gap devices. This will result in size and weight reduction that enables both a Mini-MIDS and Weapons-MIDS Capability.	LINK-16 is a critical part of the CNO's Network Centric Warfare Initiative. In addition, this is critical in meeting aircraft and weapons operational requirements associated with data communications in combat airspace. The benefits include a 40% cost reduction for the power amplifier yielding a $30M cost avoidance from FY 06 to FY 09.
Special Operations		
Combatant Craft Shock Mitigation	Mitigation of joint and soft-tissue damage to the operators and passengers of the11-meter Rigid Boat (RIB) is a top SOCOM priority.	This project will develop composite manufacturing technologies that will produce strong, flexible hulls with shock mitigating hull-to-deck joints, thereby reducing the debilitating impact on operators and passengers.

2. Leveraging the Resources of Other Organizations

a. Outside Funding (OSF) to Centers of Excellence:

A principal goal of Navy MANTECH is to increase utilization of the technical expertise residing in the Navy COEs by organizations other than MANTECH. Meeting this goal expands the national status of each COE and distributes each Center's overhead costs to organizations other than MANTECH. This OSF supports manufacturing projects at the COEs that are not Navy MANTECH funded. For FY 02:

- OSF received by all Navy Centers totaled **$47.8M** as compared to the FY 01 OSF of $18.5M, an increase of over $29M.
- This OSF amounted to 88% of the Navy MANTECH funding provided to the Centers.
- The Electro Optics Center received OSF of $24.8M from several DOD organizations, representing a leveraging of over 470% of Navy MANTECH funding.

FY 02 Outside Funding Received By COEs

COE*	Navy MANTECH Funding ($M)	OSF (Non-Navy MANTECH) ($M)	% of MANTECH Funding
BMP	2.4	3.5	146%
CMTC	8.0	0.9	11%
EMPF	8.6	3.6	42%
EOC	5.2	24.8	477%
GCRMTC	4.8	0.9	19%
iMAST	6.0	2.0	33%
NCEMT	12.5	11.6	93%
NJC	6.7	0.6	9%
Totals:	**54.2**	**47.8**	**88%**

*NOTE: See Appendix for the complete name of each COE.

Funding was distributed to the COEs through various ONR contracts and other contract vehicles. More details on the sources of outside funding and the programs funded are presented in the Appendix.

b. Cost Sharing:

Although not legislatively mandated, cost sharing of Navy MANTECH projects including funding and in-kind support by both industry and other government entities is a highly beneficial Program goal.

- Cost sharing leverages Navy MANTECH funding to achieve technical results and, in many instances, builds in an implementation partner.
- In FY 02, cost share contributions were $18M, or 33% of Navy MANTECH funding. The following table indicates the FY 02 cost share by COE.

FY 02 Cost Sharing of MANTECH Projects

COE	Navy MANTECH Funding ($M)	Cost Share ($M)	% of MANTECH Funding
BMP	2.4	0.3	12%
CMTC	8.0	0.3	4%
EMPF	8.6	9.2	107%
EOC	5.2	0.5	10%
GCRMTC	4.8	1.1	23%
iMAST	6.0	3.2	53%
NCEMT	12.5	2.3	18%
NJC	6.7	1.1	16%
Totals:	**54.2**	**18.0**	**33%**

3. Major Outreach Actions

a. Significant MANTECH Interface:

During FY 02, Navy and COE MANTECH personnel initiated and participated in numerous interface meetings to foster an improved understanding of manufacturing needs and capabilities amongst PEOs, PMs, senior Navy leaders, industry, ONR personnel, and other government entities. In the following table, some of the key interface meetings with PEOs, PMs, and other senior Navy leaders during FY 02 are arrayed against the fundamental concepts of the Navy's operational effectiveness: Sea Strike, Sea Shield, and Sea Basing. In addition, two other key meetings are identified, one with SOCOM and the second with a representative of the Missile Defense Agency.

FY 02 Significant MANTECH Interface Meetings*

PEO, PM, Senior Leadership	Purpose
Sea Basing	
P. Brown, Dep. Commander NAVSEA	Presentations to each on the Navy MANTECH Program, its goals, benefits, and its role in meeting the manufacturing challenges of the transformational Navy.
RADM Butler, NAVSEA 93	
RADM Ellis, N773	
RADM Engelhardt, N77B	
RADM Sullivan, N77	
RADM Hamilton	Introduced Navy MANTECH, CMTC, reviewed Surface Strike composites requirements.
CAPT Berthold PMS378 for RADM Dyer, Dr. C. Milligan (CTO PEO(Carriers)), A. Sandel and C.F. Snyder (PMS378)	
CAPT Needham, NAVSEA 05N	Presented current status of REPTECH projects and identified potential issues.
CAPT Townsend-Manning, NUWC Keyport	Reviewed program with new NUWC Keyport Commanding Officer.
PMS470 - Amphibious/Mine ships	Nurtured relationship with Program Office Manager. Several potential issues identified.
Landing Craft, Air Cushioned (LCAC) Program Office	Reviewed composites components for heavy-lift LCAC vehicles.
Sea Shield	
VADM Nanos, COMNAVSEA	Review of Torpedo Repair and VLS Repair projects.
RADM Sharp, PEO (MUW)	Briefed status and benefits of MANTECH projects.
PEO-Theater Air Defense and Surface Combatants, Raytheon, Thiokol, NSWC-Carderock, and NSWC-Indian Head	Discussed manufacturing problems associated with the use of rhenium in missile control systems.
PEO-Surface Combatants, NSWC-Indian Head	Discussed manufacturing problems associated with gun design and construction.
LCDR Rutherford, PMS325	Providing critical programmatic and technical support to PMS325 in Power and Battery Systems.
PMS415J Surface Ship Defense	Discussed NCEMT capabilities relative to manufacturing winch and other ship defense system components.
PMS490 Mine Undersea Warfare	Discussed NCEMT capabilities relative to manufacturing remote mine-hunting system.

PEO, PM, Senior Leadership	Purpose
B. Baudler, PMS529	Program Support in reducing the cost of MEMS IMUs for use in Extended Range Guided Munition.
A. J. Melita (Deputy Director Strategic and Tactical Systems, Munitions) and CAPT Birdwell, USN	Presentation on manufacturing / business efficiencies to decrease cycle-time, reduce inventory and improve affordability.
Sea Strike	
NAVAIR NAWC-Aircraft Division sponsored Titanium Casting Steering Group meeting	Discussed NCEMT work on titanium casting.
S. Osburne, NAVSUP PM, NUWC Keyport	F/A-18 aircraft repair work for supply support issue.
CAPT Dunaway, PMA265	Critical manufacturing support for the AESA Radar.
Other	
U.S. SOCOM Program Office	Reviewed needs for composites components for U.S. SOCOM craft.
D. Schaefer, Missile Defense Agency, visit to EMPF	Resulted in MDA providing the EMPF $2M for the WBG work on the LINK-16 Project.

*NOTE: Titles shown are positions held at the time of the meeting.

In addition, to better leverage resources, foster an awareness of Navy MANTECH, promote joint service activity and maintain customer satisfaction, Navy and COE personnel participated in the following:

- **Thirty-three Customer Interface Meetings**
  - Example: Rhenium Workshop with PEO-Theater Air Defense and Surface Combatants, Raytheon, Thiokol, NSWC-Carderock, and NSWC-Indian Head.
- **Forty-four MANTECH Project Reviews**
  - Example: Electro-Optics Center, subcontractors and project team members, Project Management Team, System Commands, and weapon system sponsors.
- **Twenty-four Interservice Other Government Agency Coordination Meetings**
  - Example: Joint Directors of Manufacturing Technology Panel (JDMTP) quarterly meetings.
- **Twenty-five Industry Interface Meetings**
  - Example: MEMS IPT Meeting. Participants--Navy, Army, Air Force, Honeywell, L3, Raytheon, Boeing Lockheed Martin. Coordination of all the MEMS IMU programs.

b. <u>MANTECH Presentations / Participation in Conferences:</u>

- During FY 02, Navy and COE MANTECH personnel participated in over eighty conferences and professional meetings.
- Ninety papers were presented at over fifty national and international conferences and symposia including the:
  - ONR Navy-Industry R&D Partnership Conference.
  - PEO/SYSCOM Conference/Workshop.
  - International Symposium on Liquid Metal Processing and Casting.
  - AeroMat 2002.

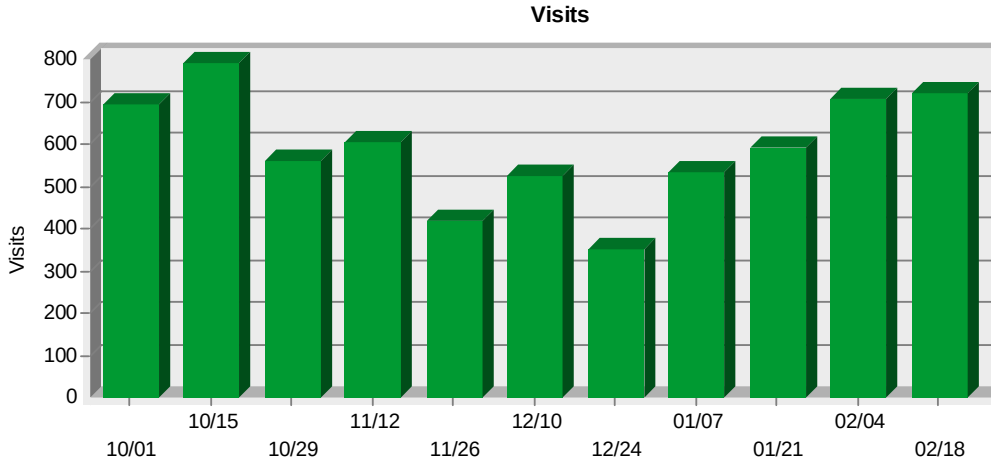
- Ship Production Symposium 2002.
- International Conference on Computer Applications in Shipbuilding (ICCAS 2002), Ship Production Symposium and International Maritime Exposition.
- SPIE International Conference on Nonlinear Optics of Liquid and Photorefractive Crystals.
- The International Congress on Applications of Laser and Electro-Optics (ICALEO 2001).

- In addition, Navy MANTECH and the COEs had thirty-seven exhibit booths and displays at over twenty technical tradeshows and conferences.

c. <u>Utilization of Navy MANTECH and COE Web Sites:</u>

Web sites provide users the opportunity to review technical capabilities of each COE, MANTECH project related data, future MANTECH events (seminars and conferences), and proceedings from past events, as well as obtain points of contact for key MANTECH personnel and request technical assistance.

- During FY 02, Navy/COE MANTECH Web sites received a total of over 1.4M hits.
- In addition, the DOD MANTECH Web site received 900,000 hits.
- In October 2002, WebTrends was installed on the Navy MANTECH Web site. The FY 03 results from October through February 2003 illustrate an average of 707 hits per day equating to forty-three verifiable visits per day. The graphic below illustrates the bi-weekly visits for the period 10/1/2002 through 2/18/2003.



d. <u>Learning Centers and Demonstrations:</u>

The education of manufacturing students and employees at all levels of experience is enhanced through the training and demonstration sessions of the COEs. Through the use of teaching factories and learning centers, advances in manufacturing technology are transferred to a wide range of industry and government personnel.

- Example: In May 2002, the Electro Optics Center and Kearfott Guidance & Navigation Corporation conducted a final end-of-project demonstration of the successful completion and transition of the Monolithic Ring Laser Gyro MANTECH project.

- Approximately thirty industry and government organizations were represented at the demonstration.
- The successfully transitioned project is expected to produce a cost avoidance of $14.1M on the anticipated acquisition of JSOW missiles.

- As indicated in the table below, during FY 02, the Navy MANTECH COEs conducted 117 training and demonstration sessions with 3,167 attendees.

FY 02 Training and Demonstration Sessions

COE	Sessions	Attendees
BMP	27	873
CMTC	25	1,009
EMPF	42	554
EOC	4	165
GCRMTC	11	349
iMAST	5	101
NJC	3	116
Totals:	**117**	**3,167**

4. Publications

a. MANTECH Articles and Papers:

During FY 02, COE and Navy MANTECH personnel published a total of forty-eight technical papers and articles in twenty-nine different publications including:

- The Welding Journal of the American Welding Society.
- The Journal of Science and Engineering of Composite Material.
- The Journal of Advanced Materials and Processes.
- The Journal of Management in Engineering.
- The Journal of Materials Engineering and Performance.
- The Journal of Ship Production.

The table below lists the thirteen peer-reviewed papers.

FY 02 Peer-Reviewed Articles and Papers by Navy MANTECH and COE Personnel

Title	Publication	Author(s)
Adam Smith on Management	Business and Society Review, Vol. 107, No. 2, Summer 2002.	Dr. P. Koening, ONR Asia
Degradation Mechanism of the Balsa Wood Core Composite Sandwich Beam from Heating from One Side	Journal of Science and Engineering of Composite Material.	D. Hui, Ph.D. and P. K. Dutta, Ph.D.
Effect of Cooling Rate on the Microstructure of Ti-6Al-4V Forging	Materials Science and Engineering Journal, 2002.	O. Senkov, J. J. Valencia, S F.H. Froes, S.V. Senkova, and M. Cavusoglu
Evaluation of High Strength Steel Castings Possessing Improved Weldability	Journal of Materials Engineering and Performance, Vol. 10, No 6.	K. Kannan and J. J. Valencia
Field-Scale Demonstration of Electrocoagulation and Enhanced Media Filtration for Treatment of Shipyard Storm Water	Journal of Ship Production	M. E. Pulido, E. J. La Motta, Ph.D., R. Nandipati, and J. Josse
Financial Viability of Fiber-Reinforced Polymer (FRP) Bridges	Journal of Management in Engineering, Vol. 10, Issue 1.	H. Nystrom, S. Watkins, T. Nanni, and S. Murray
Glass and Glass/Carbon Fiber Hybrid Composites in Submerged Load Bearing Structures	Composites Fabricators Assn. (CFA)	N. Berring, S. Murray, L. Wallendorf, and S. Mouring
Lean Production in the Japanese Shipbuilding Industry?	Journal of. Ship Production., Vol. 18, No. 3, Aug. 2002.	Dr. P. Koening, ONR Asia
Performance of Recycled Shingle Core Filled Composite Tubes	Composites Fabricators Assn. (CFA)	T. Moran, A. Garg, K. Chandrashekhara, V. Flanigan, N. Berring, and S. Murray
Powder Injection Molding to Fabricate Tungsten and Rhenium Components	Advances in Powder Metallurgy & Particulate Materials, 2001.	C. M. Wang, J. J. Cardarella, K. R. Miller and C. L. Trybus
Real-Time Marine Diesel Engine Simulation for Fault Diagnosis	Marine Technology	K. Logan, B. Inozu, Ph.D., P. Roy, J-F Hetet, P. Chesse, and X. Tauzia
Stress Analysis of a Transversely Loaded Aluminum Weldment	Marine Structures	R. G. Latorre, Ph.D. and P.D. Herrington, Ph.D.
Technical and Economic Breakdown of Value Added in Shipbuilding	Ship Production Journal, Vol. 18, No. 1, Feb. 2002.	Dr. P. Koening, ONR Asia

b. COE Newsletters:

The dissemination of information and transferring of technology is a major emphasis within the MANTECH Program. During FY 02, Navy COEs published the following:

- Hard Copy Newsletters --- distribution 91,600
- Electronic Newsletters --- distribution 32,800
- Annual Reports --- distribution 8,500

c. Navy MANTECH:

The Navy MANTECH Program Office distributes several technology transfer and informational publications during the year. These publications are distributed at various conferences and technical symposia as well as through electronic transmittals and mailings.

- Navy MANTECH Project Books (CDs) providing users with detailed information on all active MANTECH projects – 1,200 distributed.
- Navy MANTECH Points of Contact Booklets providing information on key Points of Contact within ONR Headquarters and Detachment, the Systems Commands, and Centers of Excellence – 2,500 distributed.
- "How to Do Business with Navy MANTECH" brochures providing detailed information to new MANTECH customers on the mechanics of the Program – 1,200 distributed.
- "Shipbuilding and Ocean Technology, Asia-Pacific Region" newsletter distributed two to three times per year to approximately 225 individuals.
- Quarterly bulletin, "Navy Manufacturing and Industrial Program Report", providing a description of MANTECH achievements and activities -- available through the technology transfer section of the Navy MANTECH Web site.

5. MANTECH Program Improvements

During FY 02, efforts have been made to substantially improve the MANTECH Program's responsiveness and relevance to major fleet needs. As discussed in the following sections, this has resulted in:

- A new investment strategy for the program.
- Improved communications between ONR and the Centers of Excellence.
- Actions in response to external guidance elicited by:
  - The National Research Council report "Equipping Tomorrow's Military Force – Integration of Commercial and Military Manufacturing in 2010 and Beyond".
  - A September 2001 GAO report.
  - The March 2002 Technology Area Review and Assessment (TARA).
  - The needs of the DOD Combating Terrorism Technology Task Force.

a. MANTECH Program Integrated Systems Investment Strategy:

To support the evolving needs of the Naval force and ensure wise investments, the MANTECH Program Office is restructuring operations effective in FY 04. Using Sea Power 21 and SECNAV direction as defining guidance, the MANTECH Program is implementing the Naval Integrated Systems Investment Strategy.

- Approximately 70-80% of yearly program resources will go towards this new strategy, with the balance supporting Navy MANTECH Corporate Initiatives.
- MANTECH investment will aggressively address the highest priority manufacturing issues of the highest priority Navy acquisition programs.
- Investments will be focused on a few systems early in the development cycle for maximum impact. In coordination with the CNR, the following PEOs/Thrust Area were selected for MANTECH investment in FY 04:

Naval Investment:	**Weapon Systems Focus:**
PEO (Ships)	DD (X) Family
PEO (Carriers)	CVN 21
PEO (W)	UCAV-N
PEO (TACAIR)	EA-18G / F-18 Family /E2C
PEO (IWS)	Missiles, Weapons, and Munitions
Transformational Technology	RDT&E, Logistics, Net Centric

- In close cooperation with the selected PEOs, the MANTECH staff, the Centers of Excellence, and key systems integrators will work together to identify and prioritize key manufacturing requirements to enhance successful execution of MANTECH projects and the transition of the resulting technology.
- All MANTECH projects will be evaluated on a yearly basis, ensuring that collective investments pay off.

b. Improved ONR/COE Communications:

To ensure that the COEs and their respective Contracting Officer's Representatives (CORs), Procuring Contracting Officers (PCOs), and Administrative Contracting Officers (ACOs)

were familiar with all aspects of managing a COE contract/agreement, a workshop was held between ONR Contracts and the CORs/Program Officers.

- Issues such as Overhead Rates, Annual Audit Requirements, Property Administration, Cost Sharing, Cost Accounting, Out Sourcing (subawards/subcontracts), Project Development Process, and Terms and Conditions of each award were discussed in great detail so that everyone involved understood the business rules.
- Additional meetings were then held with each COE to review the same information.
- The results of these meetings were extremely beneficial as ONR Contracts became familiar with the MANTECH players and the COEs understood from a government perspective what was expected of them to ensure a smooth contracting process.

c. <u>Responding to External Guidance and Needs:</u>

During FY 02, the MANTECH Program has continued to respond to guidance from external sources. Actions in four key areas are summarized below.

- The Joint Defense Manufacturing Technology Panel (JDMTP) is jointly funding studies conducted for the Board on Manufacturing and Engineering Design of the National Research Council. One such study, published in FY 02, focuses on the integration of commercial and military manufacturing to support defense needs. Chaired by Dr. Michael F. McGrath, the Committee on Integration of Commercial and Military Manufacturing (ICMM) in 2010 and Beyond recommended that "ManTech should be aggressively employed to foster, execute, and transition significant demonstration projects with major ICMM implications to the DOD."
  - Specific recommendations included methods to achieve six-sigma control on manufacturing lines and technologies and business practices to enable affordable, small lot size production.
  - Navy MANTECH actions to continue to support Supply Chain Best Practice projects and the BMP COE are part of the Navy response to these recommendations.
  - In addition, the Electronic Based Manufacturing using 3-D Printing Metalworking Technology project is assisting in developing commercially viable processes and techniques for solid free-form manufacturing at costs that are quantity-insensitive.

- In September 2001, the GAO issued report number GAO-01-943, "DEFENSE MANUFACTURING TECHNOLOGY PROGRAM -- More Joint Projects and Tracking of Results Could Benefit Program".
  - In response, the Navy MANTECH and COE staffs have been revising their approach to defining and tracking the objectives, goals, and metrics for all Navy MANTECH projects.
  - In addition, the JDMTP has continued to foster opportunities to identify and execute joint projects. A new process that provides a tri-service plus Defense Logistics Agency look at all potential projects within each of the manufacturing technology programs has been implemented through the JDMTP technical subpanels. The purpose is to identify opportunities for jointness during the planning processes for each program.

- In March 2002, the TARA reviewers concluded their review with a clear message that the program must continue to seek leadership support. The Navy MANTECH Program's Integrated Systems Investment Strategy, discussed in Section 5a above, is intended to address this particular issue. Through this new strategy, Navy MANTECH is focusing its resources on the most pressing manufacturing needs for the highest priority Navy systems.

- Finally, in response to 9/11, OSD established the DOD Combating Terrorism Technology Task Force (CTTTF) to identify technologies that can be rapidly transitioned into tools that can make a difference to the war on terrorism. In response to a request from OSD, ONR and the MANTECH Program are responding, as needed, with appropriate expertise. The Navy MANTECH COEs have been responding, and will continue to respond rapidly, to issues of the availability of manufacturing techniques for effectively transitioning new technologies.

APPENDIX

a. Abbreviations:

Throughout this document, the following abbreviations have been used:

Abbreviation	Center of Excellence (COE)
BMP	Best Manufacturing Practices Center of Excellence
CMTC	Composites Manufacturing Technology Center
EMPF	Electronics Manufacturing Productivity Facility
EMTC	Energetics Manufacturing Technology Center
EOC	Electro-Optics Center
GCRMTC	Gulf Coast Region Maritime Technology Center
iMAST	Institute for Manufacturing and Sustainment Technologies
NCEMT	National Center for Excellence in Metalworking Technology
NJC	Navy Joining Center
	Other Projects
Pathways	Lean-Pathways
SPANS	Supply-Chain Practices for Affordable Navy Systems
3-D Printing	Electronic Based Manufacturing using 3 Dimensional Printing Metalworking Technology

b. MANTECH Web Sites:

The following table provides the web addresses for the Navy MANTECH Program, the DOD ManTech Program, and the COE Web sites:

Web Site	Web Address
NAVY MANTECH	https://www.navymantech.com
DOD ManTech	http://www.dodmantech.com
BMP	http://www.bmpcoe.org
CMTC	http://cmtc.scra.org
EMPF	www.empf.org
EOC	http://www.electro-optics.org
GCRMTC	http://www.gcrmtc.org
iMAST	http://www.arl.psu.edu/centers/imast.html http://www.arl.psu.edu/centers/reptech.html
NCEMT	http://www.ncemt.ctc.com
NJC	http://www.ewi.org/njc

c. Sources of OSF at COEs:

The following table highlights the sources of, the amount of, and the purpose of the OSF provided to the COEs:

Source of Funding	FY 02 Funding	Purpose
BMPCOE		
USMC Dragon Eye	$125,000	Assessed risk associated with transitioning this Science and Technology (S&T) Project directly into production. Dragon Eye is a small, lightweight, reusable, expandable, man-packed, hand-launched, autonomous unmanned aerial vehicle (UAV) for "over the hill" reconnaissance. It is designed to provide the small unit commanders with near-real time tactical, reconnaissance, and surveillance information.
USMC Complementary Low Altitude Weapon System (CLAWS)	$148,000	The Complementary Low Altitude Weapons System (CLAWS) Program is an ACAT III acquisition program designed to provide an initial forced entry capability to the Marine Air Ground Task Force (MAGTF) and extends the battlespace by providing the landward piece for Naval Overland Cruise Missile Defense (OCMD) capability. Conducted a 4-month Red Team Assessment of the CLAWS Program to evaluate the Government's and contractors' ability to produce the CLAWS in response to the ORD.
NAVSEA AEGIS Ballistic Missile Defense (AEGIS BMD)	$340,000	The Navy Midcourse System, formerly Navy Theater Wide, reaches its objectives by combining five existing programs: STANDARD Missile, AEGIS Weapons Systems, Vertical Launching System, Pacific Missile Range Facility, and DOD Targets. BMPCOE performed systems engineering and risk management analyses, and reviewed each program to provide independent assessments and recommendations resulting in significant risk mitigation.
NAVSEA DASN/PEO (TSC)	$50,000	The Department of the Navy's Directorate for Missiles and Surface Launchers (PEO TSC-M/L), formerly the STANDARD Missile Program Office (PMS422), is responsible for the "cradle-to-grave" management of the STANDARD Missile and Vertical Launcher Programs. BMPCOE provides technical expertise and experience for successful program executions.
U.S. Navy Chief Engineer (CHENG)	$165,000	CHENG provides senior leadership and focus within the acquisition structure on integration and interoperability of combat, weapon, and C4I systems across all Navy and Marine Corps PEOs, DRPMs, PMs and SYSCOMS. BMPCOE provides technical expertise and experience to CHENG to accomplish Navy requirements.
USMC Lightweight 155mm Howitzer (LW 155)	$148,000	Conducted an assessment of the Program's readiness to transition to production. The Lightweight 155mm Howitzer Program is a joint program designed to provide the Marine Corps and Army with increased mobility, improved responsiveness and survivability through increased rates of fire and decreased emplacement and displacement times.

Source of Funding	FY 02 Funding	Purpose
NAVSEA PEO (TSC)-M/L (PMS422)	$517,600	BMPCOE provides technical expertise and experience across STANDARD Missile programs including specific work in the areas of Diminishing Manufacturing Sources and Material Shortages (DMSMS), Tin Whiskers, materials issues, reliability, producibility, quality, proactive identification of risks, programmatic metrics, TECHRep support and Collaborative Work Environments.
DOD DFAS	$350,000	DFAS provides responsive, professional finance and accounting services for DOD. BMPCOE provides technical expertise in the design, deployment, and continuing evolution of a Collaborative Work Environment to streamline DFAS operations.
NAVSEA STANDARD Missile Program (SM-2 BLOCK IVA)	$250,000	BMPCOE provides training, administers systems engineering and risk management processes, and ensures that best practices and sound engineering processes are promoted through the use of TRIMS. BMP identified risks early enough to be successfully mitigated, providing significant assistance in the creation of the STANDARD Missile Parts and Materials Working Group to handle DMSMS throughout all SM programs.
NAVSEA 053	$135,000	Conducted a Quick Look Assessment of the Reliability of the Advanced Integrated Electronic Warfare System (AIEWS) Program. The AIEWS was to be the replacement for the SLQ-32 deployed on Navy ships, but the prototype was not meeting the required reliability. After review of all system documentation and interviews with the government engineers instrumental in developing the System Specification document and the contractor's design engineers and scientists, it was concluded that the reliability specification was incorrectly based on performance of a mature system, and that the contractor used incorrect assumptions in their reliability design.
NAVSEA STANDARD Missile Program (SM-3 AEGIS LEAP Interceptor)	$1,000,000	Providing systems engineering and risk management analyses, and ensuring best practices and sound engineering processes are promoted/used through the use of TRIMS. Implemented DMSMS processes, developed a Web site used by all SM-3 program team members, and maintain a continuing TRIMS assessment of the ALI demonstration program. Helping to focus mitigation on risks in DT-1B and Block 1 portions of the program.
JPO Multifunctional Information Distribution System (MIDS)	$213,000	Provided systems engineering, producibility, and risk management analyses for a Joint Program Office and evaluated acquisition strategies and simulation as a tool for rapid introduction of technology. Performed on-site assessments on the maturity and capability of facility processes in each of the five participating nations.
SPAWAR DMR (Digital Modular Radio)	$39,000	Assessed the producibility of a new software programmable and hardware configurable digital radio system that significantly improves warfighter mission requirements. Assessed the production readiness of the DMR Program for SPAWAR PMW-179.
CMTC		
NAVFAC	$647,405	Fund modifications to the Joint Modular Lighter System project. CMTC selected for rapid contracting capability, and for consortium expertise in composites manufacturing.

Source of Funding	FY 02 Funding	Purpose
NSWCCD, Marine Composites Branch, Code 6552	$248,000	Topology and sizing optimization of composite advanced sail for VA-Class submarines. Principle performer -- Mississippi State University.
EMPF		
U.S. Army Communications Electronic Command (CECOM), Fort Monmouth, NJ	$512,186	AN/PRC-90 Survival Radio: Procured and tested battery adapters that permit the use of commercially available batteries in place of the custom power source currently required.
U.S. Army Project / Sub-Contract with Computer Sciences Corporation	$299,051	Land Warrior Flat Cable: Provided the Army warfighter with an interface cable to connect the full array of integrated electronic devices providing communications, navigation and computational resources, while reducing overall weight and associated environmental constraints.
U.S. Army Communications Electronic Command (CECOM), Fort Monmouth, NJ	$64,747	VPDU Project: CECOM is developing an Apollo Test Bed (ATB) for the purposes of evaluating low power/intelligent power management on a distributed network and required a variable DC-DC converter or Variable Power Distribution Unit (VPDU) that will accept a standard Army twelve VDC battery and provide up to six regulated DC outputs to power peripherals under test.
ONR	$99,037	Wide Band Gap Devices: Defined critical areas of commercial leveraging and areas of influencing device and product decisions; documented DOD and commercial performance requirements and determined areas of commonality; and surveyed COTS thermal management systems to determine applicability to specific Navy and DOD systems.
U.S. Navy PMS510	$1,754,453	REPTILE (Regional Electric Power Technology Integration & Leveraging Enterprise): REPTILE is a program to support power electronics needs of the “all electric” Navy. The major tasks include improving the manufacturability of the power conditioning modules planned for ship’s power distribution, demonstrating and testing high power devices, subsystems and applications that could be of use in the new ships; and studying critical issues for the next generation ships. The effort combines the capabilities of the EMPF and NSWC-Philadelphia to accomplish these tasks.
U.S. Army Communications Electronic Command (CECOM), Fort Monmouth, NJ	$124,815	Fiber Optic Gyro (FOG) Integration: The project strategy is to identify Commercial Off the Shelf (COTS) Attitude Heading and Reference (AHRS) Line Replaceable Unit (LRU) candidates for the UH-60 helicopter fleet. This project is being performed to identify qualified OEM contractors with compatible FOG systems that are superior to the current spinning mass gyroscopes.
U.S. Army Communications Electronic Command (CECOM), Fort Monmouth, NJ	$767,685	C6533A Intercom: Developed and designed prototypes of a form, fit and function COTS replacement intercom unit for the AH-1, CH-47D, OH-58 A/C UH-1H/1V and UH-60A/L Army rotary wing aircraft. The replacement unit consists of a single board LRU that replaces a multi-board, discrete component 1969 design that incorporates a large number of obsolete components and discrete wire interconnects.

Source of Funding	FY 02 Funding	Purpose
EOC		
Missile Defense Agency--Quality Reliability & Manufacturing Office (QRM)	$2,400,000	MDA/Navy Two Color Long-Wave Focal Plane Arrays to improve target discrimination and increase probability of target intercept.
Air Force Research Laboratory--MLPS Office	$160,000	Arsenic-doped HgCdTe infrared focal plane array materials science to improve the producibility of basic materials required for focal plane arrays for reduced cost and improved focal plane array performance.
Air Force Research Laboratory--MLPS Office	$115,000	Infrared focal plane array materials science optical properties to improve producibility and focal plane array performance.
Air Force Research Laboratory--MLPO Office	$659,000	SiC APVT crystal growth to reduce the defect rate, improve yield, and decrease cost of Silicon Carbide substrates for increased applications in high power density electronics and electro-optic systems.
ONR	$2,305,000	Advanced Diode Array Manufacturing (ADAM II) – implementation of automated testing of diode arrays to lower the cost and improve the yield of laser diode arrays for high-energy laser applications.
NAVSEA--Directed Energy Program Office	$4,540,000	Integration of Electro-Optic Technologies for Ship Self Defense -- analysis of charring effects on missile radomes to improve high-energy laser capabilities in ship self defense.
Special Operations Command (SOCOM)	$3,645,000	SOCOM Dual Band Imaging Technologies -- development of next generation night vision equipment.
Air Force Research Laboratory--Materials Directorate	$4,173,000	Advanced Semi-Insulating Silicon Carbide Substrate Technology--materials technology to increase the power density capabilities in S-Band and X-Band for increased range and improved target identification and characterization.
U.S. Army CECOM Night Vision Laboratory	$2,408,000	Third Generation Focal Plane Array -- large format night vision system for improved target acquisition and identification in night vision environments. Increase lethality due to ability to recognize enemy at greater range and in clutter.
U.S. Army--PM FLIR/PM Night Vision	$3,000,000	Avenger FLIR upgrade development providing higher probability of kill (Pk) and extended range, increasing the lethality of the weapon.
Air Force--Joint Strike Fighter Program Office	$350,000	Infrared Focal Plane Array Process Fabrication Improvements -- for the JSF electro-optic distributed aperture sensor utilized in the missile warning and targeting systems, resulting in reduced cost and increased yield.
NAVSEA--PMS422 (PEO Theater Surface Combatants)	$1,000,000	MDA/Navy Two Color Long-Wave Focal Plane Arrays for improved target discrimination and increased probability of kill on the Standard Missile.

Source of Funding	FY 02 Funding	Purpose
GCRMTC		
Northrop Grumman Ship Systems - Avondale Operations was awarded Navy (NAVSEA) contract. NGSS - Avondale contracted the work to the Simulation Based Design Center.	$901,880	Modeling and simulation support for onboard LPD 17 operations.
iMAST		
Pennsylvania DEP/EPA	$75,000	Grant funding to support Wastewater Solids Recycling project for Pennsylvania implementation.
North Carolina DEP/EPA	$25,000	Wastewater Solids Recycling analysis.
National Center for Manufacturing Sciences	$20,000	Issue for Portsmouth Naval Shipyard - advanced cutting technology.
National Center for Manufacturing Sciences	$10,000	Issue for MCLB Albany regarding Abrasive Flow Machining.
Naval Sea Systems Command	$10,000	Technical support to Puget Sound Naval Shipyard on specification writing, quote analysis, and implementation of MANTECH.
Naval Air Systems Command / NADEP CP	$741,000	Abrasive Flow Machining (coatings removal) evaluation for repair of F404 turbine blade engine components.
Army MANTECH (Army ARL)	$424,600	Austempered ductile iron ausforming of various components on M1A2 Abrams vehicle.
NASA	$80,000	Theoretical work on laser beam processing.
Department of Energy	$25,000	Laser free-forming of Gd and Hf bearing stainless steels.
Laser Processing Consortium Members	$150,000	Laser processing research.
Virginia Class Program Office, PMS450	$445,000	Leachable core testing.
NCEMT		
Tank-automotive Armaments Command - Army	$169,000	Developed concepts for new advanced metallic bridging system.
Armaments Research, Development and Engineering Center - Army	$110,000	Developed processing technique to produce improved surface quality on titanium slab ingots made by hearth melting.
NAVAIR PMA299 Air ASW, Assault and Special Mission Programs, MH-69R Air Vehicle Engineering Lead	$2,000,000	Teamed with Sikorsky Aircraft to reengineer selected dynamic components on H-60 helicopter to increase life.
NAVAIR PMA-299 Air ASW, Assault and Special Mission Programs	$2,000,000	Teamed with Sikorsky Aircraft to redesign forward-looking infrared radar for H-60 helicopter.

Source of Funding	FY 02 Funding	Purpose
Tank-automotive Armaments Command – Army	$4,900,000	Continued materials and process research in support of Army efforts to design and build new generation of combat vehicles.
NAVSEA 05M Materials	$2,400,000	Executed metallic materials advanced development and certification program teaming with NSWC-Carderock in support of implementing new materials and processes in shipbuilding.
NJC		
U.S. Army Armaments Research and Development Engineering Center, Picatinny Arsenal	$150,000	Welding Process Control for Lightweight Howitzer Project: Leverages Navy MANTECH support of LW155mm Howitzer Program and Total Ownership Cost Reduction FNC. Objective is increased productivity and reduced repair and rework.
NSWC Indian Head - Countermeasures Program PEO (MUW)	$427,671	Welding Procedures for Munitions: Supports Naval Gun Systems & JDAM Programs and Total Ownership Cost Reduction FNC. Welding process is critical to munitions performance.